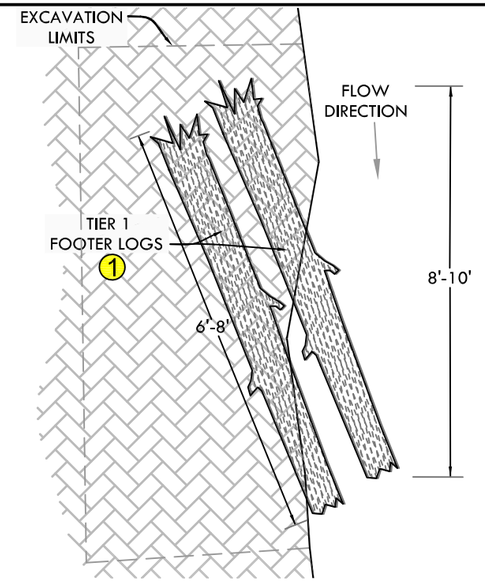
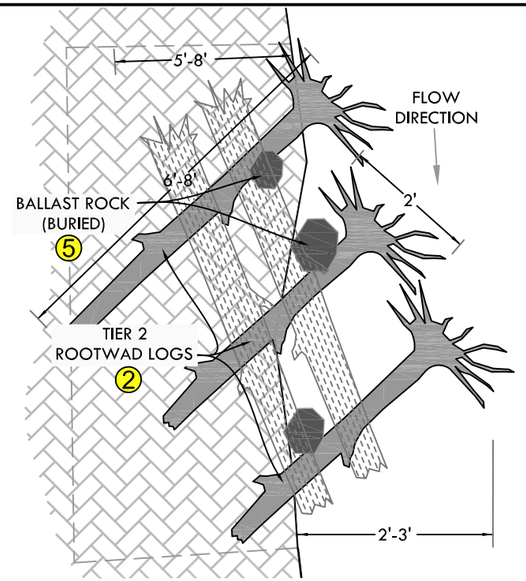
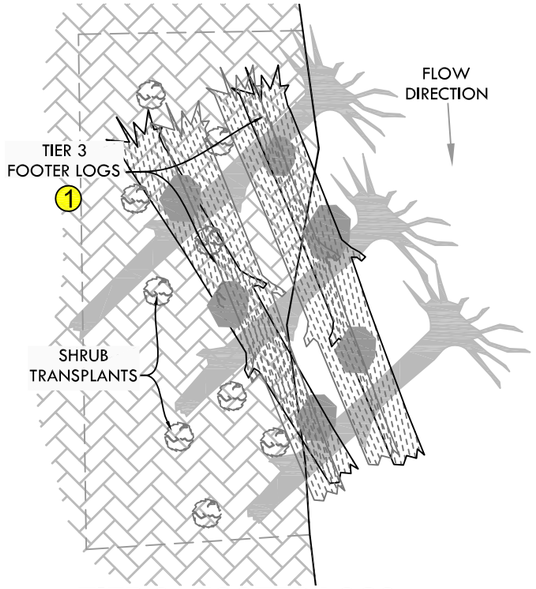


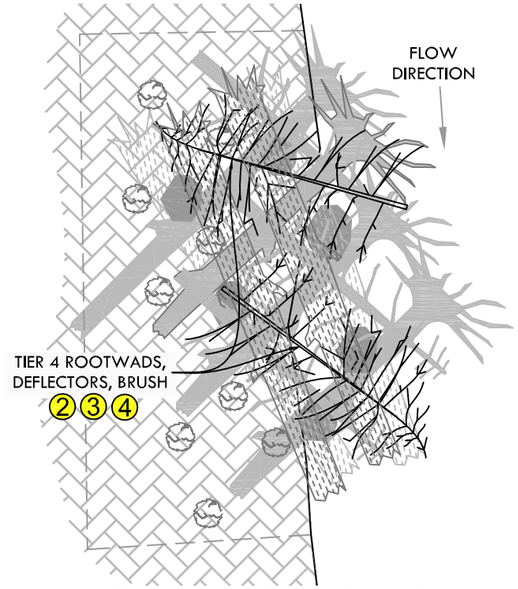
TIER 1 - FOOTER LOGS
PLAN VIEW NTS



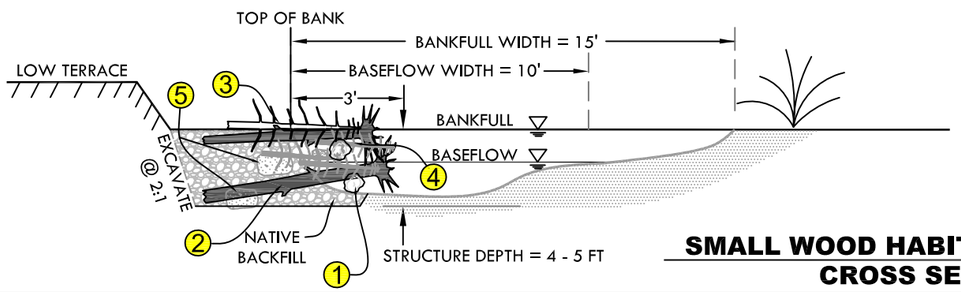
TIER 2 - ROOTWAD LOGS & BALLAST ROCK
PLAN VIEW NTS



TIER 3 - FOOTER LOGS
PLAN VIEW NTS



TIER 4 - ROOTWADS, DEFLECTORS, BRUSH
PLAN VIEW NTS



SMALL WOOD HABITAT STRUCTURE
CROSS SECTION NTS

DESIGN INTENT

The small wood habitat structure provides bank protection by re-directing flow away from the bank, dissipating energy, and maintaining a lateral scour pool. Typically structures are placed along the outer bank of a low-radius meander bend. Structure performance is dependent upon placement within a sequence of other channel bank and bed structures. Structure design life is temporary and intended to provide short-term stability until the project site is revegetated and recovers from disturbance. Over time the structure will decompose or become abandoned/buried in the floodplain as natural processes take over and the channel migrates across the floodplain.

CONSTRUCTION NOTES

Excavate trench and set footer logs at specified depth. Use footer logs with minimum diameter and stem length as specified. Footer logs shall not have a rootfan. If possilbe, backfill up to top of footer logs with specified alluvial backfill. Douse backfill periodically with water to improve compaction and minimize void spaces.

Set rootwad logs on footer logs. Place logs stems sloping downward into bank from edge of water. Use rootwads with minimum rootfan diameter and stem length as specified. Backfill up to top of rootwad logs and place ballast rocks on top of rootwad logs at locations where rootwad logs intersect footer logs. Douse backfill periodically with water to improve compaction and minimize void spaces.

Add additional tier of footer logs and rootwad logs as shown and described above. Cover ballast rocks and top of structure with alluvium as approved by the Construction Manager. Place deflector logs and brush on top tiers as shown .

The Construction Manager shall inspect and approve all footer logs and rootwad logs prior to backfilling. Notify Construction Manager of any proposed changes prior to implementation. The Construction Manager reserves the right to modify structure design specifications during construction if warranted due to unforeseen conditions.

MATERIAL SCHEDULE (PER STRUCTURE)

ITEM	*QUANTITY*	*DIA. (IN)*	*LENGTH (FT)*	*ROOTWAD (Y/N)*
1 FOOTER LOG	4	10-14	6-8	NO
2 ROOTWAD LOG	4	12-20	6-8	YES-2 FT DIA.
3 DEFLECTOR LOG	3	6-12	6	OPTIONAL 1-2 FT
4 CY OF BRUSH	2	3-6	4-8	NO
5 CY OF RIP-RAP	2	18		

EXAMPLE OF A CONSTRUCTED SMALL WOOD HABITAT STRUCTURE

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SMALL WOOD HABITAT STRUCTURE DETAIL

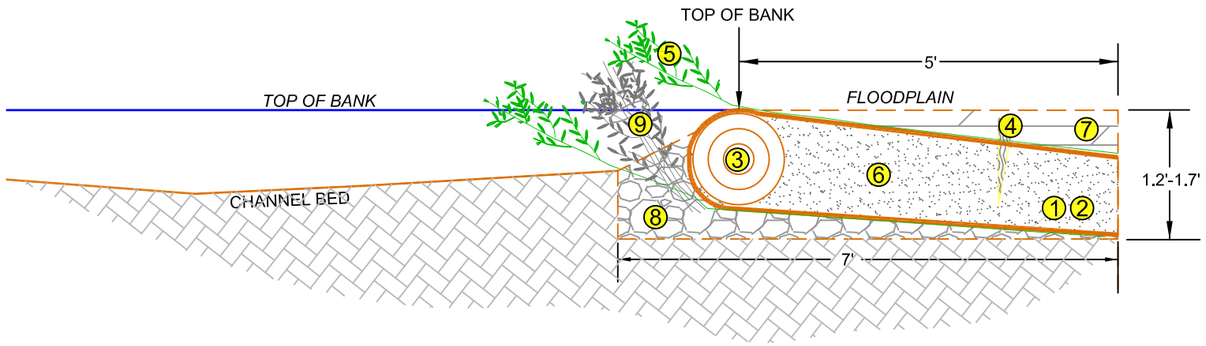
Owl Creek Restoration Project
Condon, Montana

NO.	DATE	BY	DESCRIPTION	CHK
1	7-20-11	NW	RESTORATION PLAN	JM

PROJECT NUMBER
RDG-10-068

SHEET NUMBER
DT-1

NUMBER OF SOIL LIFTS AND LENGTH OF TREATED BANK IS CALLED OUT ON SPECIFIC DRAWING SCHEDULE



SINGLE SOIL LIFT CROSS SECTION

0' 1' 2'

EXAMPLE OF A CONSTRUCTED SINGLE SOIL LIFT

DESIGN INTENT

The vegetated soil lift structure is a bioengineering technique that employs coir fabrics to provide conditions along the channel banks that are suitable for growing woody riparian vegetation. Vegetated soil lifts provide bank protection when used in conjunction with a sequence of other channel bed and bank structures. Typically the structure is placed along the outer bank of high-radius meander bends exhibiting poor soil conditions and a lack of vegetation. Structure performance is dependent upon vegetation growth and placement of cuttings at elevations in contact with the baseflow water table during the growing season. The design life of the structure is temporary and intended to provide short term stability until woody vegetation becomes established. Over a five to ten year period, the coir products will decompose and the rooting strength of established vegetation is intended to maintain low bank erosion rates.

CONSTRUCTION NOTES

Bench Construction:
Contractor shall place 6-inch minus alluvium to build the toe and bench of the structure as shown. Contractor shall place 6-inch minus alluvium unless suitable material is present as approved by Engineer. Engineer shall inspect and approve the toe and the bench prior to coir product installation.

Soil Lift Construction:
Contractor shall place coir mat on top of the bench. Coir mat shall be placed first with approximately half of the coir mat width extending toward the channel beyond the front edge of the bench. Coir mat seams shall overlap at least three feet longitudinally from upstream to downstream. Coir fabric shall be placed on top of coir mat. Coir logs shall be placed on top of the coir fabric at the front edge of the bench as shown.

Contractor shall place a soil and gravel mixture, or other fine-textured material generated from on-site excavation and approved by Engineer, to fill the lift. Backfill shall be placed on the bench behind the coir log and on top of the coir fabric to the top of the coir log. Fill should taper down from the top of the coir log to a depth of six (6) to eight (8) inches at the back edge of the bench. Contractor shall compact backfill using bucket compaction.

Contractor shall wrap the coir mat and coir fabric around the coir log, tension the coir mat and coir fabric to remove slack, and stake the coir mat and coir fabric into the backfill and toe material using a 2-inch by 4-inch by 18-inch wedge stake. The stake shall extend through both the bottom and top edges of the coir mat and coir fabric. All overlaps in coir mat and coir fabric shall be staked with a minimum of two (2) stakes. Contractor shall secure the coir mat and coir fabric ends tightly by folding the coir mat and coir fabric with the top edge of folds going with the direction of stream flow.

Contractor shall place six (6) to eight (8) foot long dormant willow cuttings at a density of ten (10) stems per linear foot on top of Soil Lift 1. Willow cutting stems may overlap. The cut ends shall be placed on Soil Lift 1 with the un-cut ends extending beyond the edge of the bench so that no more than one-third of the total cutting length is exposed. Contractor shall place 0.2 feet of growth media on top of willow cuttings.

Backfill:
After construction of specified number of lifts, Contractor shall backfill the soil lift structure with excavated on-site material approved by Engineer. Contractor shall compact backfill using bucket compaction. Contractor shall stabilize structure end points with rock or logs as requested by Engineer. The upstream and downstream ends of the vegetated soil lift should transition smoothly into a stable streambank, channel structure or other bioengineering structure to reduce the potential for short-term erosion. Contractor shall place 0.3 feet of growth media on top of 8-inch plus backfill.

MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	DIMENSION	QUANTITY
1	LF OF COIR MAT (SOIL LIFT 1)	13' x 165' (roll)	1.0
2	LF OF COIR FABRIC	13' x 165' (roll)	1.0
3	12" COIR LOG - SOIL LIFT 1		0.1
4	WOODEN WEDGE STAKES	2" x 4" x 18"	1
5	WILLOW CUTTINGS		10
6	CY OF GRAVEL/SOIL MIX		0.7
7	CY OF GROWTH MEDIA		0.1
8	CY OF 8-INCH PLUS ALLUVIUM		0.1
9	CY OF 3'-6' DIA. BRUSH	5' - 8'	0.2

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SINGLE VEGETATED SOIL LIFT WITH BRUSH LAYERING DETAIL

Owl Creek Restoration Project
Condon, Montana

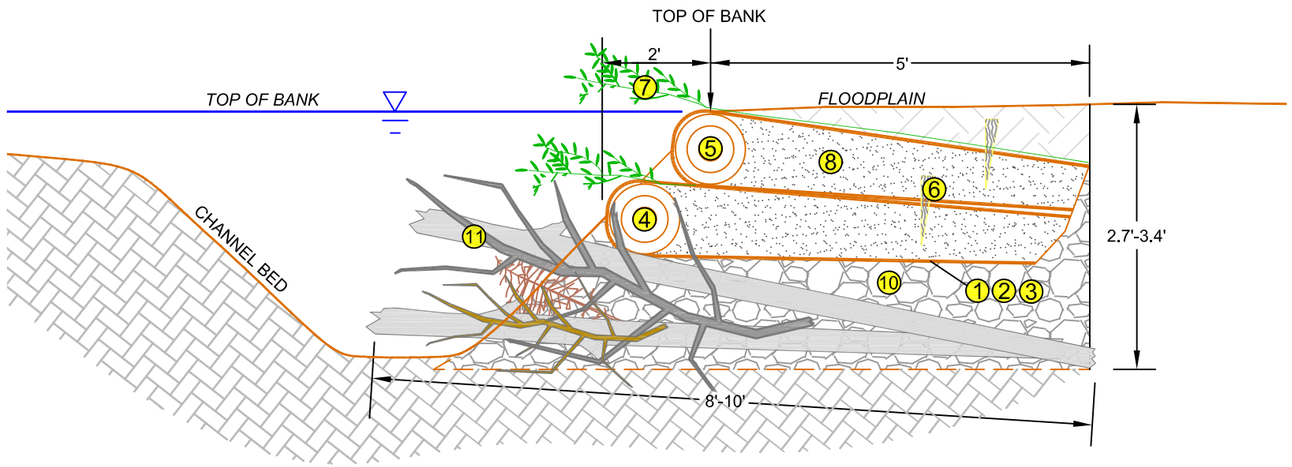
NO.	DATE	BY	DESCRIPTION	CHK
1	7-20-11	NW	RESTORATION PLAN	JM

PROJECT NUMBER
RDG-10-068

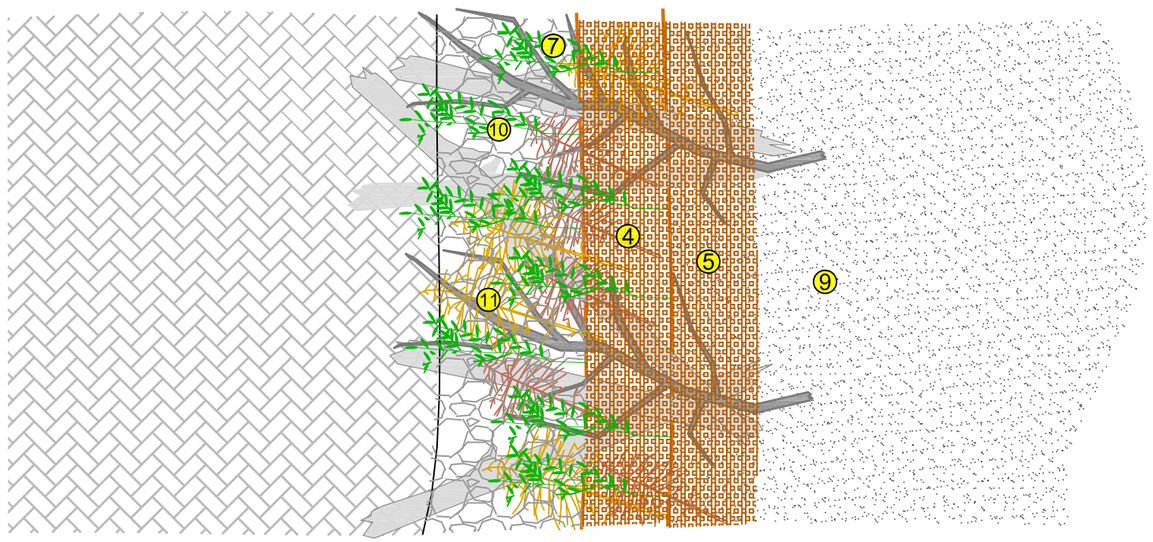
SHEET NUMBER

DT-2

NUMBER OF SOIL LIFTS AND LENGTH OF TREATED BANK IS CALLED OUT ON SPECIFIC DRAWING SCHEDULE



DOUBLE VEGETATED SOIL LIFT WITH BRUSH LAYERING
CROSS SECTION
0 1' 2'



DOUBLE VEGETATED SOIL LIFT WITH BRUSH LAYERING
PLAN VIEW
0 1' 2'

DESIGN INTENT

The double vegetated soil lift with brush layering structure is a bioengineering technique that employs coir fabrics to provide conditions along the channel banks that are suitable for growing woody riparian vegetation. Vegetated soil lifts provide bank protection when used in conjunction with a sequence of other channel bed and bank structures. Typically the structure is placed along the outer bank of high-radius meander bends exhibiting poor soil conditions and a lack of vegetation. Structure performance is dependent upon vegetation growth and placement of cuttings at elevations in contact with the baseflow water table during the growing season. The design life of the structure is temporary and intended to provide short term stability until woody vegetation becomes established. Over a five to ten year period, the coir products will decompose and the rooting strength of established vegetation is intended to maintain low bank erosion rates.

CONSTRUCTION NOTES

Bench Construction:
Contractor shall place 8-inch plus alluvium to build the toe and bench of the structure as shown. Place brush and backfill with with 8" plus to form a bench for soil lift 1. Contractor shall place 8-inch plus alluvium unless suitable material is present as approved by Engineer. Engineer shall inspect and approve the toe and the bench prior to coir product installation.

Soil Lift Construction:
Contractor shall place coir mat on top of the bench. Coir mat shall be placed first with approximately half of the coir mat width extending toward the channel beyond the front edge of the bench. Coir mat seams shall overlap at least three feet longitudinally from upstream to downstream. Coir fabric shall be placed on top of coir mat. Coir logs shall be placed on top of the coir fabric at the front edge of the bench as shown.

Contractor shall place a soil and gravel mixture, or other fine-textured material generated from on-site excavation and approved by Engineer, to fill the lift. Backfill shall be placed on the bench behind the coir log and on top of the coir fabric to the top of the coir log. Fill should taper down from the top of the coir log to a depth of six (6) to eight (8) inches at the back edge of the bench. Contractor shall compact backfill using bucket compaction.

Contractor shall wrap the coir mat and coir fabric around the coir log, tension the coir mat and coir fabric to remove slack, and stake the coir mat and coir fabric into the backfill and toe material using a 2-inch by 4-inch by 18-inch wedge stake. The stake shall extend through both the bottom and top edges of the coir mat and coir fabric. All overlaps in coir mat and coir fabric shall be staked with a minimum of two (2) stakes. Contractor shall secure the coir mat and coir fabric ends tightly by folding the coir mat and coir fabric with the top edge of folds going with the direction of stream flow.

Contractor shall place six (6) to eight (8) foot long dormant willow cuttings at a density of ten (10) stems per linear foot on top of Soil Lift 1. Willow cutting stems may overlap. The cut ends shall be placed on Soil Lift 1 with the un-cut ends extending beyond the edge of the bench so that no more than one-third of the total cutting length is exposed. Contractor shall place 0.2 feet of growth media on top of willow cuttings.

The above sequence shall be repeated for areas scheduled for a second soil lift to be constructed on top of Soil Lift 1 as specified on the Drawings. Contractor shall place six (6) to eight (8) foot long dormant willow cuttings at a density of two (2) stems per linear foot on top of Soil Lift 2.

Backfill:
After construction of specified number of lifts, Contractor shall backfill the soil lift structure with excavated on-site material approved by Engineer. Contractor shall compact backfill using bucket compaction. Contractor shall stabilize structure end points with rock or logs as requested by Engineer. The upstream and downstream ends of the vegetated soil lift should transition smoothly into a stable streambank, channel structure or other bioengineering structure to reduce the potential for short-term erosion. Contractor shall place 0.3 feet of growth media on top of 8-inch plus backfill.

MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	DIMENSION	QUANTITY
1	LF OF COIR MAT (SOIL LIFT 1)	13' x 165' (roll)	1.1
2	LF OF COIR MAT (SOIL LIFT 2)	13' x 165' (roll)	1.1
3	LF OF COIR FABRIC	13' x 165' (roll)	2.2
4	12" COIR LOG - SOIL LIFT 1		0.1
5	12" COIR LOG - SOIL LIFT 2		0.1
6	WOODEN WEDGE STAKES	2" x 4" x 18"	1
7	WILLOW CUTTINGS		10
8	CY OF GRAVEL/SOIL MIX		0.7
9	CY OF GROWTH MEDIA		0.1
10	CY OF 8-INCH PLUS ALLUVIUM		0.25
11	BRUSH	8' - 10'	0.4

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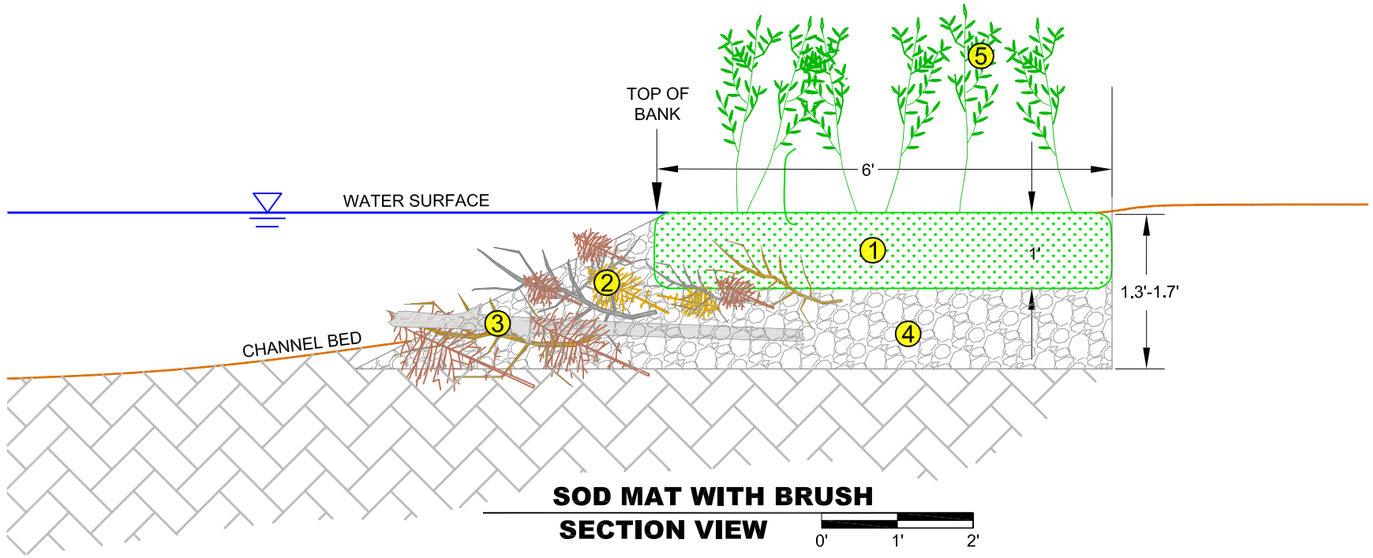
DOUBLE VEGETATED SOIL LIFT WITH BRUSH LAYERING DETAIL

Owl Creek Restoration Project
Condon, Montana

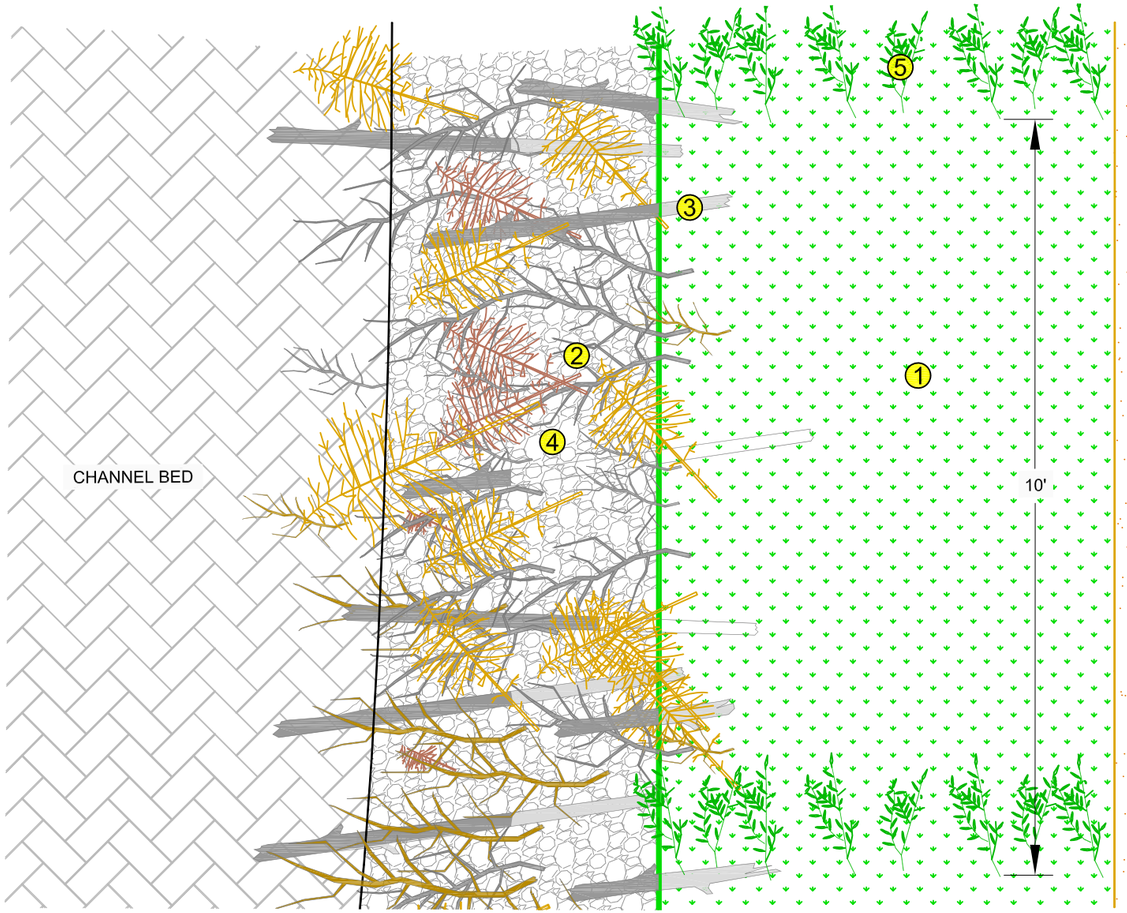
NO.	DATE	BY	DESCRIPTION	CHK
1	7-20-11	NW	RESTORATION PLAN	JM

PROJECT NUMBER
RDG-10-068

SHEET NUMBER
DT-3



SOD MAT WITH BRUSH
SECTION VIEW
0' 1' 2'



SOD MAT WITH BRUSH
PLAN VIEW
0' 1' 2'

DESIGN INTENT

The intent of this treatment is to provide temporary bank protection along newly constructed streambanks. This treatment includes placement of wetland sod mats and small diameter brush intermixed with willow cuttings to provide streambank toe protection and habitat. Willow cuttings are intended to provide shade, rooting strength and cover along the channel margins. Typical structure placement is along straight, lower stress margins of the new channel.

CONSTRUCTION NOTES

Excavate trench down to specified depth. Place and stack sod and brush pieces as shown. Backfill sod and brush with 8-inch plus alluvium.

MATERIAL SCHEDULE (PER LINEAL FOOT)

	ITEM	*QUANTITY*	*DIA. (IN)*	*LENGTH (FT)*
1	SOD MAT	18 SF	6-12 (THICK)	3 X 6
2	BRUSH	0.4	3-6	10 - 15
3	SMALL LOGS	0.4	<6	10 - 15
4	CY OF 8-INCH PLUS ALLUVIUM	0.1		
5	WILLOW CUTTINGS	10	0.25	6

EXAMPLE OF A CONSTRUCTED SOD MAT BRUSH BANK

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SOD MAT BRUSH BANK DETAIL

Owl Creek Restoration Project
Condon, Montana

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PROJECT NUMBER
RDG-10-068

SHEET NUMBER
DT-4